Claims

[1] A plasma source coil comprising:
a bushing arranged at a center part; and
a plurality of unit coils arranged in the form of a concentric circle from a circumference of the bushing on the basis of the bushing,
wherein one end of each unit coil and one end of the bushing are commonly connected to a power-supply terminal, and the other end of each unit coil and the other end of the bushing are commonly connected to a ground terminal.

[2] The plasma source coil according to claim 1, wherein the bushing is formed of a conductive material.

[3] The plasma source coil according to claim 1, wherein the plurality of unit coils are each configured in the form of a circle.

[4] The plasma source coil according to claim 1, wherein the plurality of unit coils have a convex-type structure so that their position is lowered in proportion to a distance from the bushing.

[5] The plasma source coil according to claim 4, wherein at least two unit coils arranged at the outermost position from among the plurality of unit coils are arranged on the same plane.

[6] The plasma source coil according to claim 1, wherein the plurality of unit coils have a concave-type structure so that their position is elevated in proportion to a distance from the bushing.

[7] The plasma chamber according to claim 6, wherein at least two unit coils arranged at the outermost position from among the plurality of unit coils are arranged on the same plane.

[8] A plasma source coil comprising:
a plurality of lower unit coils arranged in the form of a concentric circle on a first plane in a lower part; and
a plurality of upper unit coils arranged in the form of a concentric circle on a second plane in an upper part,
wherein one ends of the lower unit coils are commonly connected to a power-supply terminal and the other ends thereof are commonly connected to a ground terminal, and one ends of the upper unit coils are commonly connected to the power-supply terminal and the other ends thereof are commonly connected to the ground terminal.

[9] The plasma source coil according to claim 8, wherein a distance among the lower unit coils and a distance among the upper unit coils are each indicative of 0.5~2cm.

[10] The plasma source coil according to claim 8, wherein the lower unit coils and the upper unit coils are connected to each other via connection lines connected to the power-supply terminal and the other connection lines connected to the ground terminal.

[11] A plasma source coil comprising:
a bushing vertically arranged in the form of a cylinder at a center part;
a plurality of lower unit coils arranged in the form of a concentric circle on a first plane where the bottom of the bushing is located; and
a plurality of upper unit coils arranged in the form of a concentric circle on a second plane where the top of the bushing is located,
wherein one ends of the lower unit coils are commonly connected to a power-supply terminal and the other ends thereof are commonly connected to a ground terminal, and one ends of the upper unit coils are commonly connected to the power-supply terminal and the other ends thereof are commonly connected to the ground terminal.

[12] The plasma chamber according to claim 11, wherein the bushing is connected to the power-supply terminal and the ground terminal.

[13] The plasma source coil according to claim 11, wherein a distance among the lower unit coils and a distance among the upper unit coils are each indicative of 0.5~2cm.

[14] The plasma source coil according to claim 11, wherein the lower unit coils and the upper unit coils are connected to each other via connection lines connected to the power-supply terminal and the other connection lines connected to the ground terminal.

[15] A plasma source coil comprising:
a plurality of unit coils arranged in the form of concentric circles having different radiuses while having a common center part,
wherein one ends of the unit coils are commonly connected to a power-supply unit, the other ends thereof are commonly connected to a ground terminal, and the unit coils are connected to each other via at least one connection line.

[16] A plasma source coil comprising:
a plurality of unit coils arranged in the form of concentric circles having different radiuses on the basis of a bushing arranged at a center part,
wherein one ends of the unit coils are commonly connected to a power-supply unit, the other ends thereof are commonly connected to a ground terminal, and the unit coils are connected to each other via at least one connection line.

[17] The plasma source coil according to claim 16, wherein the plurality of unit coils have a convex-type structure so that their position is lowered in proportion to a

distance from the bushing.

[18] The plasma source coil according to claim 16, wherein the plurality of unit coils have a concave-type structure so that their position is elevated in proportion to a distance from the bushing.

[19] A plasma source coil comprising:
a plurality of lower unit coils arranged in the form of a concentric circle on a first plane in a lower part; and
a plurality of upper unit coils arranged in the form of a concentric circle on a second plane in an upper part,
wherein one ends of the lower unit coils are commonly connected to a power-supply terminal and the other ends thereof are commonly connected to a ground terminal, one ends of the upper unit coils are commonly connected to the power-supply terminal and the other ends thereof are commonly connected to the ground terminal, and
the lower unit coils are connected to each other via at least one lower connection line, and the upper unit coils are connected to each other via at least one upper connection line.

[20] A plasma source coil comprising:
a bushing vertically arranged in the form of a cylinder at a center part;
a plurality of lower unit coils arranged in the form of a concentric circle on a first plane where the bottom of the bushing is located; and
a plurality of upper unit coils arranged in the form of a concentric circle on a second plane where the top of the bushing is located,
wherein one ends of the lower unit coils are commonly connected to a power-supply terminal and the other ends thereof are commonly connected to a ground terminal, and one ends of the upper unit coils are commonly connected to the power-supply terminal and the other ends thereof are commonly connected to the ground terminal, and
the lower unit coils are connected to each other via at least one lower connection line, and the upper unit coils are connected to each other via at least one upper connection line.

[21] A plasma chamber comprising:
an exterior wall and a dome for defining a reaction space in which plasma is formed;
a support arranged at a lower part of the reaction space to support a semi-conductor wafer to be processed; and
a plasma source coil including a bushing arranged at a center part, a plurality of unit coils arranged in the form of a concentric circle from a circumference of the

bushing on the basis of the bushing, wherein one end of each unit coil and one end of the bushing are commonly connected to a power-supply terminal, and the other end of each unit coil and the other end of the bushing are commonly connected to a ground terminal.

[22] A plasma source coil comprising:
a bushing arranged at a center part; and
a plurality of unit coils, which are extended from the bushing, and are spirally wound on the bushing,
wherein the unit coils have different surface areas in a first wafer area having a predetermined radius from a center part, a second wafer area enclosing the first wafer area, and a coil edge area enclosing the second wafer area.

[23] The plasma source coil according to claim 22, wherein the unit coils are arranged to have a predetermined turning number "n" calculated using a predetermined equation of n=ax(b/m) (where "a" and "b" are both positive integers, and "m" is indicative of the number of unit coils corresponding to an integer greater than "2").

[24] The plasma source coil according to claim 22, wherein the surface areas of the unit coils are maintained constant, are gradually reduced, or are gradually increased, as a distance to an edge part in the first wafer area decreases.

[25] The plasma source coil according to claim 22, wherein the surface areas of the unit coils are gradually increased, are maintained constant, or are gradually reduced, as a distance to an edge part in the second wafer area decreases.

[26] The plasma source coil according to claim 22, wherein the surface areas of the unit coils are maintained constant, are gradually reduced, are gradually increased, or are gradually reduced, as a distance to an edge part in the coil edge area decreases.

[27] The plasma source coil according to claim 22, wherein the first wafer area and the second wafer area overlap a wafer surface to be processed.

[28] The plasma source coil according to claim 22, wherein a radius from a center part of the first wafer area to an edge part thereof is equal to or less than about 10~30% of an entire radius of a wafer, a width of the second wafer area is equal to about 70~90% of an entire radius of the wafer, and a width of the coil edge area is equal to about 30~50% of an entire radius of the wafer.

[29] The plasma source coil according to claim 22, wherein the second wafer area includes a first area adjacent to the first wafer area and a second area adjacent to the coil edge area.

[30] The plasma source coil according to claim 29, wherein the degree of variation in surface area of each unit coil in the first area of the second wafer area is different

from that in the second area of the second wafer area.

[31] The plasma source coil according to claim 29, wherein a width of the first area of the second wafer area is about 60~90% of a total width of the second wafer area, and a width of the second area of the second wafer area is about 10~40% of the total width of the second wafer area.

[32] A plasma chamber comprising:
an exterior wall and a dome for defining a reaction space in which plasma is formed;
a support arranged at a lower part of the reaction space to support a semi-conductor wafer to be processed;
a plasma source coil including a bushing arranged at a center part, a plurality of unit coils extended from the bushing while being spirally wound on the bushing, wherein the unit coils have different surface areas in a first wafer area having a predetermined radius from the center part on the dome, a second wafer area enclosing the first wafer area, and a coil edge area enclosing the second wafer area;
a support rod arranged at a predetermined area of a center part of the bushing; and
a power-supply unit connected to the support rod to provide the plasma source coil with power.

[33] The plasma chamber according to claim 32, wherein the unit coils are arranged to have a predetermined turning number "n" calculated using a predetermined equation of n=a×(b/m) (where "a" and "b" are both positive integers, and "m" is indicative of the number of unit coils corresponding to an integer greater than "2").

[34] The plasma chamber according to claim 32, wherein the surface areas of the unit coils are maintained constant, are gradually reduced, or are gradually increased, as a distance to an edge part in the first wafer area decreases.

[35] The plasma chamber according to claim 32, wherein the surface areas of the unit coils are gradually increased, are maintained constant, or are gradually reduced, as a distance to an edge part in the second wafer area decreases.

[36] The plasma chamber according to claim 32, wherein the surface areas of the unit coils are maintained constant, are gradually reduced, are gradually increased, or are gradually reduced, as a distance to an edge part in the coil edge area decreases.

[37] The plasma chamber according to claim 32, wherein the first wafer area and the second wafer area overlap a wafer surface to be processed.

[38] The plasma chamber according to claim 32, wherein a radius from a center part

of the first wafer area to an edge part thereof is equal to or less than about 10~30% of an entire radius of a wafer, a width of the second wafer area is equal to about 70~90% of an entire radius of the wafer, and a width of the coil edge area is equal to about 30~50% of an entire radius of the wafer.

[39] The plasma chamber according to claim 32, wherein the second wafer area includes a first area adjacent to the first wafer area and a second area adjacent to the coil edge area.

[40] The plasma chamber according to claim 39, wherein the degree of variation in surface area of each unit coil in the first area of the second wafer area is different from that in the second area of the second wafer area.

[41] The plasma source coil according to claim 39, wherein a width of the first area of the second wafer area is about 60~90% of a total width of the second wafer area, and a width of the second area of the second wafer area is about 10~40% of the total width of the second wafer area.

[42] A plasma apparatus comprising:
a process chamber including a wafer;
a bias power unit for providing a back surface of the wafer with bias power;
a plasma source coil structure disposed at the outside of an upper part of the process chamber to convert reaction gas contained in the process chamber into plasma, including: a coil bushing at a center part, and at least two unit coils which are extended from the coil bushing, are spirally wound on the coil bushing such that a distance between a coil positioned at a specific radial point and the other coil adjacent to the coil is gradually reduced and is then increased, as a distance from the center part to a radial edge increases; and
a source power unit for providing the plasma source coil structure with source power for generating the plasma.

[43] The plasma apparatus according to claim 42, wherein the unit coils contained in the plasma source coil structure are wound on the coil bushing at a pre-determined turning number of 1 or more.

[44] The plasma apparatus according to claim 42, wherein an area of the plasma source coil structure is greater than an area of the wafer by about 50% or less.

[45] The plasma apparatus according to claim 44, wherein the unit coils are wound to allow a specific position capable of providing a minimum distance among the unit coils to be included in the wafer area.

[46] The plasma apparatus according to claim 45, wherein the specific position having the minimum distance among the coils is positioned adjacent to an edge part of the wafer area, whereby an area in which the distance among the coils is re-increased after passing through the specific position is less than the other area

in which the distance among the coils is reduced.